



### REMARKS

Claim 1 now clearly reads that the mixture of vapors is formed , when said carrier gas contacts said liquid in said bubbler, forming bubbles therein which agitate and mix in said liquid, the vapors comprising carrier gas and solid precursor. This feature of the invention was noted by the Examiner as not present in Claim 1 heretofore.

The Examiner is respectfully requested to reconsider his rejection of the claims as being unpatentable over Wen, in view of Tenhover.. Applicants again refer to the role of the "liquid" in the present application and in Wen. The liquid(s) referred to therein are used in completely different ways, to different purposes, and in physically different locations within the respective CVD apparatuses of disclosed by Applicants and Wen.

The present invention insures constant uniform mixing of the carrier gas with the vapors emanating from the powdered precursor material. It does so by : 1) incorporating said precursor in an ultra-low vapor pressure liquid in which it is insoluble; 2) placing the resulting slurry/suspension/emulsion in the interior of the bubble of the apparatus, the interior being defined as that volume in which the carrier gas can flow; 3) flowing the carrier gas exactly as one would do with a liquid precursor.

When these steps are carried out the splashing and agitation of the slurry incorporating the precursor serves to facilitate uniform mixing of the carrier gas and the precursor vapor. This feature is now explicated specifically in Claim 1.

Second, the present invention uniquely and unprecedentedly prevents the finely divided solid particles from recrystallizing into larger crystallites. which would lower the delivery rate of precursor vapor. It achieves this goal, as explained at length in the specification, by virtue of the insolubility of the precursor in the liquid in which it is suspended, and the concomitant separation thus effected between the solid and vapor phases of the precursor.

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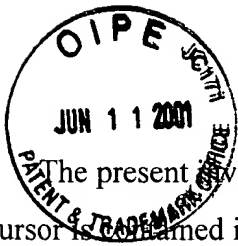
As noted in the prior submission by Applicants, the Wen reference discloses a system in which solid precursor alone, absent suspending liquid phase, is present in the interior of his "bubbler". (see material 11 in Fig. 3 of Wen, and col. 4, lines 32-33 ). Wen attempts to solve the problem of non-constant precursor mixing by adopting a novel shape for the walls enclosing the interior of his "bubbler" and relying on a combination of gravity and gas flow pattern. Thus the term "bubbler" is clearly a misnomer in Wen's device, as there is no liquid phase in which the carrier gas can form bubbles, in contrast with Applicants' invention as now claimed where mixing is achieved by the agitation of the suspending liquid caused by the actual bubbling of the carrier gas through the liquid. \

The only liquid referred to at all by Wen in his entire disclosure is the liquid comprising his heat bath.

Heat baths are a common technique for thermostating chemical processes. Applicants do not contend that there is any novelty in the use of such a heat bath. Note that the heat bath in Wen (See Fig. 3, element 13) is clearly physically separated from precursor 11, by the various walls defining the interior of the bubbler (Fig 3, items 21-24) . Clearly no carrier gas (Fig. 3, element 14) is present in region 13.

In summary, Wen uses a liquid, of unspecified properties, as a heating agent. His invention clearly offers no efficacy whatsoever with regard to the problem of substrate recrystallization, which is an object of the present invention and which the present invention solves.

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The present invention, by way of contrast, uses a carefully specified liquid in which solid precursor is contained in an insoluble suspension for the purpose of promoting mixing and for the amelioration of the recrystallization problem, not as a method to supply heat to the precursor. Thus it is a mere coincidence that liquids are employed, albeit to different ends and with different effects, in the two inventions.

Examiner in the prior Official Action takes official notice that oils of high heat capacity, such as silicone oil may be employed in heating baths. Again, this assertion is not pertinent to the present invention, as the present invention contains no heating bath. Ultralow vapor pressure is not generally a requirement for the liquids used in heating baths, and thus the fact that a given oil might be profitably employed in a heating bath is no basis for asserting that it would be a suitable suspending agent for the purposes of the present invention. The former is based upon physical properties whereas the latter is controlled by the chemical properties.

For instance, at moderate temperatures, *water* is a common liquid used in heating baths, but its vapor pressure is many orders of magnitude too high to be employed in the present invention. By analogy, Wen's liquid and Applicants' have about as much to do with one another as gasoline and hydraulic brake fluid. Both of the latter may be found in some, but not all, automobiles, but are deployed in different locales and used to different purposes and have different characteristics bearing directly on their essential respective functionalities. Applicants submit that Wen is a minor variation on the prior art of solid-gas only delivery systems and does not anticipate Applicants' invention in any way.

There is no basis to combine the reference to Tenhover with Wen. Tenhover is merely an assembly of specific instances of performing CVD reactions. Tenhover does not disclose the design of vapor delivery systems employing solid source precursors.

Applicants have invented an improved delivery system. It may be applied to any number of CVD processes, or to other purposes not specifically mentioned. The instant invention facilitates a wide variety of such processes by improving the delivery system.

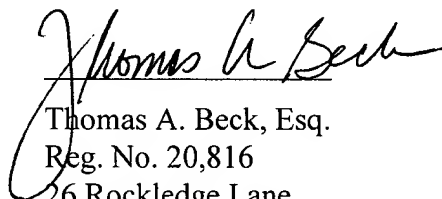
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Applicants' attorney has attempted to revise the Claim 1 in accordance with the Examiner's remarks in the Official Action as to agitating the liquid by bubbling. The claim clearly distinguishes over the references cited. If the Examiner believes that there are other modifications to be made to the claims which would result in their allowability, Applicants' attorney would be willing to discuss the matter with the Examiner by telephone at a mutually convenient time.

In view of the arguments presented and amendment to the claims, allowance of the claims is respectfully solicited.

Respectfully Submitted,



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I hereby certify that this paper is being telefaxed to Mr. Paul D. Strain at (703) 305- 3599 on the date indicated below addressed to Commissioner of Patents & Trademarks, Washington, D.C. 20231

Signature:   
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Date: June 8, 2001